REMARKS/ARGUMENTS

Claims 1 to 20 are currently pending in the application. Claim 1 has been amended. Support for the claim amendment may be found in the specification on page 7, lines 7 to 27. Accordingly, no new matter has been added with the current amendment.

Rejections Under 35 USC §103 Over Peker, Suresh & Peker-Johnson

The Examiner rejected claims 1 to 8, 10 to 17, 19 and 20 under 35 U.S.C. §103(a) over Peker (USPN 5,866,254) in view of Suresh (Fundamental of Metal-Matrix Composites) and Peker-Johnson (USPN 5,288,344). Applicant respectfully traverses this rejection.

The current invention is directed to a method of forming fully-dense composites of Bulk-Solidifying Amorphous Alloy (BSAA) with a high-volume fraction of reinforcements. A particular objective of the invention is to achieve a high packing efficiency of the reinforcement wherein the volume fraction of those reinforcements is more than 50% by volume and preferably more than 75 % by volume of the overall composite. As discussed in the "Background" section of the application, even though composites with low-volume fraction reinforcement are produced rather readily, composites with "high-volume" fraction reinforcement are much more difficult to process and fabricate. (Specification, page 1, lines 22 to 28.)

The current invention achieves this objective through a number of novel techniques including, "delaying" the shaping/forming process, and splitting the overall composite fabrication process into two steps, namely "densification" and "shaping/forming", which was discussed in Applicant's previous submission. (See, June 23, 2008 Amendment.) However, in addition to this requirement, Applicant also requires that the reinforcement and the alloy be blended and packed into a pre-mixed

feedstock prior to such densification. (See, Specification, page 7, lines 7 to 27.) Specifically, the current invention teaches two separate approaches to achieving a two-step fabrication process. The first process requires forming a blended mixture of solid reinforcement/BSAA particles and packing those particles. The second process requires that the packed particles be heated above the melting temperature of the BSAA and force applied once the BSAA has been melted to form the densified composite. In short, Applicant's method combines solid and liquid state composite methodologies into a single process.

Applicant has surprisingly found that this multiple densification process, where in effect a pre-densified feedstock is then further heated and compressed, allows for the formation of high-volume reinforcement composites of BSAAs having packing densities as high as 99%. (See, Specification, page 8, lines 5 to 8.) Moreover, Applicant would submit that such a process is simply not indicated by the teachings of the prior art. Indeed, the Examiner has highlighted the distinctions in the prior art by focusing on methods in which the reinforcement and alloy are only mixed once the alloy is heated to above its melting temperature. For example, in direct contradiction to the teachings of the current invention, both the Suresh publication and the Peker patent only describe a densification step in which "a porous body of the reinforcing phase within a mold" is infiltrated or mixed "with molten metal". (Suresh, pg. 3, Section 1.1.1, first paragraph, and FIG. 1.1; and Peker '254, col. 6, line 60 to col. 7, line 35.) That none of the prior art references teach the necessary information to allow one of skill in the art to arrive at the claimed combined solid/liquid composite formation method is made clear through careful review of the disclosures, which describe the processes contained therein as follows:

- "Infiltration processes involve holding a porous body of the reinforcing phase within a mold and infiltrating it with molten metal

that flows through interstices to fill the pores and produce a composite." (Suresh et al., page 3, Section 1.1.1, first paragraph.)

- "The bulk-solidifying amorphous alloy is melted, and the reinforcement particles are dispersed in the melt, numeral 44. In this context, "dispersed" can mean either that the reinforcement particles are mixed into a volume of the molten metal or that the melt is infiltrated into a mass of the reinforcement particles. In either case, the final composite has reinforcement particle distributed throughout the volume of the matrix material." (Peker '254, col. 6, lines 60 to 67.)

The use of a two-step solid/liquid densification process is crucial and surprising for two reasons. First, the BSAA needs to be cooled sufficiently fast to retain its amorphous structure and this causes significant complications in a single-step process, including processes in which the BSAA must be infiltrated quickly with a cold reinforcement with limited porosity and high density. For example, as described in the Suresh reference the use of cold dies (to achieve the necessary cooling rates for BSAAs) causes major problems during infiltration of composites with high-volume fraction reinforcements. (Suresh, pg. 5, Section "1.1.1.4 Other Forces", 2nd paragraph.) Moreover, because higher forces must be used, a direct liquid introduction method can result in the deformation and breakage of the reinforcement. Accordingly, it is important to provide a properly packed feedstock "mixture" so that as little wetting by the BSAA as possible is required. And yet, such solid mixing is specifically discouraged in the Suresh reference, which states:

> A majority of the commercially viable applications are now produced by liquid-state processing because of the inherent advantages of this processing technique over solid-state techniques. That is, the liquid metal

is generally less expensive and easier to handle than are powders, and the composite material can be produced in a wide variety of shapes, using methods already developed in the casting industry for unreinforced metals. (Suresh, page 1, col. 1, second paragraph.)

Accordingly, Applicant would submit that one of ordinary skill in the art, having read the combined disclosures of the Peker ('254), Suresh and Peker-Johnson ('344) references, simply would not have been provided the necessary details to create the two-step solid-solid and liquid-solid densification method claimed in the current application. Specifically, a densification process including an initial solid blending/packing step, as claimed, is never described in any of the Peker ('254) or Peker-Johnson patents or the Suresh publication. Indeed, the only method consistently taught by these references is one involving the introduction of a molten BSAA into a cold reinforcement phase either under pressure or by simple mixing. As such, Applicant would request reconsideration and withdrawal of this rejection.

Rejections Under 35 USC §103 Over Peker, Suresh & Szuecs

The Examiner also rejected claim 9 under 35 U.S.C. §103(a) over Peker (USPN 5,866,254) in view of Suresh (Fundamental of Metal-Matrix Composites) and Szuecs (Acta. Mater. (2001)). Applicant respectfully traverses this rejection for the reasons cited above. Although Applicant acknowledges that the Szuecs publication does provide a teaching of a ductile phase BSAA, the reference does not provide any teachings that would correct the deficiencies of the underlying Peker and Suresh references.

Rejections Under 35 USC §103 Over Peker, Suresh, Peker-Johnson & Neil

The Examiner also rejected claim 18 under 35 U.S.C. §103(a) over Peker (USPN 5,866,254) in view of Suresh (Fundamental of Metal-Matrix Composites), Peker-Johnson

(USPN 5,288,344) and Neil (USPN 4,952,353). Applicant respectfully traverses this rejection for the reasons stated above. Namely, although the Neil reference does describe a hot-isostatic process, again the reference does not provide any teachings that would correct the deficiencies of the underlying Peker and Suresh references.

Conclusion

In view of the foregoing amendment and response, it is believed that the application is in condition for further examination. If any questions remain regarding the allowability of the application, Applicant would appreciate if the Examiner would advise the undersigned by telephone.

The Commissioner is hereby authorized to charge any fees under 37 CFR 1.16 and 1.17 which may be required by this paper to Deposit Account No. 50-4407. Please show our docket number with any charge or credit to our Deposit Account.

Respectfully submitted,

KAUTH, POMEROY, PECK & BAILEY LLP

By John W. Peck

John W. Peck
Registration No. 44,284
949.852.0000

JWP/t